Geoscientific
Model Development
Discussions

GMDD

Interactive
comment

Interactive comment on "ORCHIDEE-SOM: Modeling soil organic carbon (SOC) and dissolved organic carbon (DOC) dynamics along vertical soil profiles in Europe" *by* Marta Camino-Serrano et al.

Anonymous Referee #2

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This is a well written manuscript documenting the improvements made in modeling soil carbon dynamics in the ORCHIDEE land surface model. Authors modeled the vertical SOC and DOC dynamics, and suggest for data assimilation in order to optimize the model parameters for regional and global application of ORCHIDEE- SOM. The findings of this manuscript are directly relevant to the readership of the GMD journal. I have provided my comments/suggestions from the perspective of a soil scientist.

- At many places in the manuscript, authors mentioned that this study also modeled the lateral transport of SOC and DOC from soil to rivers and lakes. But while looking at proposed equations, I could not figure out how was that done? To appropriately model

the lateral transport of SOC, DOC (which is an important component of SOC dynamics) authors need to use surface hydrology equations that uses the role of topographic features in lateral transport of carbon and other nutrients. In general, this model could be valuable if authors can vary the mentioned soil processes vary along with the soil forming factors (eg. Topography, vegetation types, climate, soil wetness etc.). The data of environmental data of soil forming factors are available globally at a variety of resolutions.

- Soil depth determines the volume of SOC and DOC at certain location. I don't think an assumption of homogenous soil depth of 2m globally is valid. Because the soil depth may range from few centimeters to many meters depending upon the certain location and its soil type.

- P5 L10-15: Can these layers represent soil horizons? Soil horizons determine the physical, chemical, biological properties of soils at a certain depth. It will be ideal if the depth discretization can at least try to mimic the soil horizons.

- P6L10: In my knowledge none of the global models represent pedogenic processes that are important to soil carbon dynamics such as podzolization, organo-mineral complexation, clay migration, soil aggregation, pedoturbation etc. I don't expect authors to represent all of these processes in this paper, but it will be reasonable if authors can indicate in their limitations section that these processes are important to soil C dynamics and are not represented in land surface models currently.

- P6L17: What about surface organic layer thickness, which is present in forest, grassland, and tundra ecosystems?

- P6L25-26: I don't think its a reasonable assumption to think that the above ground litter layer is a fixed parameter. It should vary at least according to the land cover types or Pfts.

- P6L30: How this depth relates with the actual soil depth?

- P7L1: I think the control of soil moisture and temperature on SOC decomposition should vary along with other soil-forming factors.